

## **EXPLORING SURVEY METHODOLOGIES FOR COLLECTING RECREATIONAL ANGLER EXPENDITURE DATA**

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### **ABSTRACT**

Beginning in 1998 on the East Coast of the United States (US) and ending on the West Coast of the US in 2000, the National Marine Fisheries Service (NMFS) conducted a series of surveys to gauge marine recreational angler expenditures by region. These surveys were conducted using the Marine Recreational Fisheries Statistical Survey (MRFSS) to gather a sample frame for a telephone follow-up survey focusing on trip and annual expenditures. Since the MRFSS was not conducted in Alaska, Hawaii, or Texas during this timeframe, those states were not included in the analysis. NMFS repeated this effort in 2006, but altered the methodology for a number of reasons. For the 2006 effort, the MRFSS survey was used to collect trip expenditures in the field and collect a sample frame for a follow-up mail survey of annual expenditures on the East and Gulf Coasts. For the California, Oregon, Washington, Alaska, Hawaii, and Texas, states not participating in the MRFSS in 2006, a license frame mail survey was conducted collecting both trip and annual expenditure information. Additionally, recreational Highly Migratory Species permit holders were also surveyed, a telephone survey of non-respondents was conducted, and a side-by-side survey mode comparison was conducted. Selected expenditure and economic impact estimates will be presented based on completion of impact modeling currently underway. Also, a comparison of expenditures across respondents and non-respondents, across mail and telephone modes, and between HMS permit holders and general anglers will be presented.

**Keywords:** Survey research, household expenditure surveys, survey methodology

### **INTRODUCTION**

Recreational angling is a very important activity to the United States (US) and marine recreational angling a popular outdoor sport nationwide when measured by number of participants. The National Marine Fisheries Service (NMFS) has been collecting recreational catch, effort, and participation data since 1979 in an effort to examine the impact anglers have on the resource. With the passing of the Magnuson-Stevenson Fishery Conservation and Management Act (MSFCMA) in 1996, Congress additionally mandated the analysis of the economic impacts on fishing participants and coastal communities of management policies.

Beyond the policy analysis mandate, it is important to identify and assess the economic effects of recreational fishing activities on communities and fishery dependent and independent businesses. First, documentation of recreational expenditures allows state resource management agencies to identify infrastructures that are directly and indirectly linked to angler purchases. Also, estimates of recreational fishing expenditures can be used to assess the economic effects of sportfishing when evaluating marina space or new business development.

Assessing the economic impacts of saltwater recreational angling first requires collecting data on anglers' trip and annual expenditures on marine sport fishing. In 2006 NMFS conducted this survey for the second time in all regions. This paper will explore changes made to the methods NMFS' uses to assess angler expenditures.

While the focus here is not expenditure and economic impact estimates themselves, some survey results are provided to lend perspective. In 2006, 24.7 million anglers took 127.2 million saltwater recreational trips in the United States (US). These trips generated \$5.8 billion in trip based expenditures, such as ice, bait, and gas, and angler spending during 2006 on durable goods, such as boats and fishing rods, generated an additional \$25.6 billion dollars. As these expenditures made their way through the US economy, the trip expenditures generated \$13.6 billion in total sales, \$7.1 billion in value added, or contribution to the gross domestic product, \$4.1 billion in income, and supported 108,596 jobs. The spending on durable goods generated an additional \$68.7 billion in total sales, \$32.0 billion in value added, \$19.9 billion in income, and supported 425,217 jobs.

In years past, the survey was conducted by region in different years due to budget limitations, and this approach resulted in slightly different methodologies being applied across the different regions complicating national totals and regional comparisons. To eliminate this issue and develop a consistent methodology for future surveys, many changes were made for the 2006 effort.

First, the survey was truly a national survey. It was conducted across all coastal states within the same year. That means that Texas, Alaska, and Hawaii were surveyed for the first time. Additionally, the Highly Migratory Species (HMS) permit frame was used to form an additional stratum, another first for this survey. For this first truly national survey, the survey mode was changed from a telephone survey to a mail survey. The trip expenditure form was moved to the intercept survey in states where the intercept survey is conducted. Anglers participating in the field were then sent a mail survey to capture their durable good purchases. In states without an intercept survey, license frames were used to mail a survey including both trip and annual expenditure questions.

The focus of this paper is to examine the effects of these various survey methodology changes. To examine the change in survey mode, the sample was split in Florida, the state with the highest level of field sampling, and a telephone survey identical to the mail survey was conducted. Additionally, it has been hypothesized that HMS anglers have higher trip and annual expenditures than other anglers. Finally, while response rates were generally high when compared to other household expenditure surveys, a telephone non-response survey was conducted. The remainder of this paper will detail survey methods used, compare those methods with past methods, and use statistical tests to examine any differences.

## **SURVEY METHODOLOGY**

This survey effort utilized a number of sampling frames. Across the United States there currently is no complete and consistent frame of saltwater anglers as several states do not have a saltwater license. The Marine Recreational Information Program (MRIP), conducts an intercept creel survey on the East Coast, Gulf Coast, except Texas, and in Hawaii. This survey platform represents the best, most consistent sample frame for saltwater anglers in states covered by the MRIP. Within the MRIP coverage area, an add-on to the intercept survey was used to collect expenditures resulting from the intercepted trip and gather a frame for mailing a follow-up survey regarding annual durable expenditures. However, there are coverage gaps in the MRIP for collecting national level data as the entire West Coast, Texas, and Alaska are not covered. In these states, license frames were used to contact anglers via a mail survey regarding both trip and durable good purchases.

### **The MRIP**

The MRIP consists of two independent and complementary surveys. These two surveys are stratified to provide independent estimates of catch, effort, and participation across states, fishing modes, and two month waves through each year. The fishing modes used for this stratification are: shore mode, private or rental boat mode, and party or charter boat mode. This method of stratification has proven useful for developing estimates annually or seasonally and it allows individual regions to easily add sample within strata to increase the precision of the estimates.

The first survey is an intercept survey of marine anglers at fishing access sites. This survey attempts to obtain a random sample of all marine recreational fishing trips. The MRIP maintains a list of over 6,000 sites in a master site list, which is continuously updated. Each of these sites is ranked by an index of relative fishing pressure by mode, month, and weekday or weekend designation. For a given date, interviewers are assigned to a specific site and to a specific mode of fishing. Interviewers are also given two adjacent, alternate sites if a minimum number of interviews cannot be obtained at the original site assignment. Sampling for private/rental and party/charter modes is conducted after the angler's fishing day has been completed. Sampling for the shore mode may be conducted when at least two-thirds of the fishing for the day has been completed and the angler then estimates total trip effort.

The intercept sampling implies a three-stage-sampling framework. In stage one, a given site/day is randomly selected with probability of assignment proportional to the fishing pressure index of the site for that specific day (Cochran 1977). The second stage involves the selection of angling parties, boatloads, groups, or individuals, at the assigned site. Finally, stage three involves possible sub-sampling among the angling parties selected in stage two. Selection of parties (stage 2) and sub-sampling among parties (stage 3) is assumed random with equal probabilities. This allows the use of self-weighting estimators to obtain mean catch-per-trip estimates for each species across all strata.

This intercept survey is a creel survey primarily used to estimate mean catch-per-trip by species. Data elements collected during the base part of the intercept survey include state, county, and zip code of residence, hours fished, primary area fished, target species, gear used, and days fished in the last two and 12 months. The creel portion of the survey collects length and weight of all fish species retained by the angler and the species and disposition of all catch not retained by the angler.

For a given stratum, estimates of mean catch-per-trip multiplied by an estimate of the total number of trips (effort) equals the total catch for that stratum. The effort estimates are obtained through the second part of this survey process; the telephone survey of coastal households. Residential households are sampled randomly using the random digit dialing technique as described by Groves et al. (1988). All anglers in the contacted household are identified, and each is asked about their fishing activity for the previous two-month period. Multiple attempts are made to contact identified anglers. This survey is used to estimate effort by coastal residents living in households with telephones. Ratios from the intercept survey are used to correct these effort estimates to account for non-coastal residents and coastal residents who do not have telephones, as those groups are not covered in the household sampling frame. Data elements collected for this survey include the number of trips in the last two months and the number of trips in the last 12 months. For trips in the last two months, trip dates, mode, time of return, and state of access are also collected.

In the previous expenditure survey efforts, (see Steinback et al 2001, Gentner et al 2001, and Gentner et al 2001a), an intercept add-on survey was used to collect a few basic demographic characteristics and a respondent telephone number. The telephone number was then used to contact the angler to collect trip and durable expenditure information via a telephone follow-up survey. In order to increase sample sizes for the trip expenditure data, the trip expenditure questions were moved to the intercept add-on survey. This change in methodology reduced standard errors, increasing the precision of the trip expenditure estimates overall.

To collect trip expenditures, interviewers were asked to attempt an add-on with every participant in the creel portion of the survey. In the MRIP survey area, 110,719 economic add-ons were attempted in 2006 and 99,755 contained at least a home zip code allowing the calculation of travel distance and private transportation expenditures. Overall, 68,632 respondents completed majority of the intercept add-on survey. A sample of all questionnaires used can be obtained by contacting the author of this paper. Intercept survey participants supplying a mailing address were sent a mail survey.

The intercept survey collects overnight trip information, from those on overnight trips, including number of days away from residence, number of days spent fishing, lodging expenses, and the purpose of the trip. All anglers are asked travel costs, days of fishing in last two months, fishing ability, boat ownership, trip supply expenditures (bait, ice, refreshments, boat fees, etc.).

The mail follow-up survey is dedicated to the collection of detailed expenditure, socioeconomic, and demographic data. Expenditure data categories include semi-durable goods (tackle, rods, reels, line, etc.), durable goods (motor boats and accessories, non-motorized boats, boating electronics, mooring, boat storage, boat insurance and vehicles or homes) and angling accessories and multi-purpose items (magazines, club dues, saltwater angling specific clothing and camping gear). Also, the expenditure survey collects a set of socioeconomic and demographic variables.

A mail survey was chosen over another telephone survey due to a number of concerns including: recall of detailed durable expenditures during a short telephone survey, the growing prevalence of cell phone only households, and falling response rates for telephone surveys in general. To compare this change in methodologies, a side-by-side telephone survey was conducted in Florida. Results of comparisons made will be reported below.

### **Mail Survey**

The mail survey followed a Dillman four contact methodology for intercepted anglers, Highly Migratory Species (HMS) permit holders, Hawaii Commercial Marine License (CML) holders, and in Texas, which requires a separate saltwater license (Dillman, 2000). The mailing sequence included a pre-notification letter, a survey and cover letter, a reminder postcard, and a final survey and cover letter mailing. HMS permit holders are not frequently intercepted by the base MRIP survey and it was hypothesized that these anglers would have vastly different expenditure habits than other anglers intercepted by the MRIP survey.

All HMS permit categories were sampled, general, charter, and angling, because it is thought that some recreational only HMS anglers purchase other license categories for the higher trip catch limits and the ability to sell catch. A similar phenomenon occurs in Hawaii where a CML can be purchased by fishermen, including recreational fishermen, so that catch can be sold. While the MRIP is conducted in Hawaii, the survey samples at lower sampling rates than on the mainland, and due to the nature of shore access of many of the islands, shore mode anglers can be difficult to contact. To augment the sample in Hawaii, the CML data base was utilized as well as voluntary angler sign-up through tackle shops and various fishery events attended by NMFS personnel.

Mail survey questions were designed so that anglers holding permits that allow fish sales could be post stratified as commercial fishermen, expense fishermen, or recreational fishermen based on their survey responses. These questions included whether or not catch was ever sold or whether the fishermen chartered their boat for paying customers. A recreational fisherman was defined as a fisherman that had not sold any fish nor chartered their boat during the previous 12 months. Additional questions were asked regarding the percentage of income earned from the sale of fish or vessel charters and this data was used to separate commercial from expense fishermen. Generally, this post stratification followed Hamilton and Huffman's (1997) work with the Hawaiian small boat fleet. Only those fishermen that sold no fish nor conducted any charters in the previous year were included in the comparisons in this paper.

Because California, Oregon, Washington, and Alaska do not differentiate licenses for saltwater and freshwater fishing an additional contact was necessary in these states. In California, names and addresses for the mailing were collected via the California's Recreational Fisheries Survey (CRFS) existing telephone survey of licensed anglers. Details of their surveying methodology are available on the Pacific States Marine Fisheries Commission web site (PSMFC 2008). In all license frame states, the sampling was conducted on a wave basis to correspond to the intercept survey and in an effort to capture seasonality in trip expenditures.

Additional sample augmentation was required in California as well. Saltwater anglers are exempt from licensure when fishing from a man made structures like piers and jetties where a significant amount of fishing effort occurs. As such, they would never be contacted through the CRFS. Additionally, for-hire anglers are contacted infrequently during the CRFS telephone survey, prompting the CRFS to conduct intercept interviews in both the man-made shore and for-hire modes. As a result, the intercept portion of the CRFS was used to collect additional sample for the mail survey by collecting the names and addresses of participants intercepted in the shore and for-hire fishing modes.

In Oregon, Washington and Alaska, a brief telephone screening survey was conducted. State license files were used for the dialing. Phone numbers were validated and missing phone numbers found using a private phone number look-up service. A maximum of ten attempts were made to contact anglers. If license holder took a saltwater fishing trip in the previous 12 months in the state of licensure, the respondent was deemed eligible to participate in the mail survey and mailing address details were verified.

In California, actual sampling protocol was controlled by Pacific States Marine Fisheries Commission (PSMFC, 2008). In all other license frame states, sample was randomly drawn, stratified by resident status, every two months from the most recent version of the entire license database without replacement. These samples were drawn proportionally to effort occurring during the same period for the previous year or the latest year that effort was estimated for the state. The target sampling intensity was 10% of the licensed saltwater anglers, but because sampling targets were formulated using the previous year's license frame and because Oregon, Washington, and Alaska required a prescreening survey, actual sampling rates varied from that target. Final wave sampling in all license frame states, besides California, was delayed until each state could provide their final and complete sample frame for 2006.

Survey versions were personalized based on the state of intercept or licensure, including framing of state specific questions and graphics. Otherwise, questions were identical for every intercept state. The license frame state versions were different from the intercept version only in that the trip expenditure questions were added to the mail survey in the license frame states. In the license frame states, the trip expenditures were anchored to the most recent saltwater trip taken. Additionally details collected by the MRIP intercept survey were collected in the license frame surveys in order to have similar data on the referent trip.

Table 1 details the total sample size, completed surveys and response rate. Across the license frame and intercept based sample, usable sample size for the trip expenditures was 118,146 observations and for the durable good expenditures 18,391 observations. Response rates are fairly consistent and generally favorable. One notable exception is Texas. In this state, all licenses that allowed saltwater fishing were sampled. This included a large number of combination license holders (31.2%) that buy licenses that allow saltwater fishing along with freshwater fishing and/or hunting. A recent survey by Texas Parks and Wildlife Department indicates that only 55.1% of Super Combo and 43.5% of Senior Super Combo license holders actually fish in saltwater (Leitz, 2007). It is likely that any Texas combination license holder that did not fish in saltwater would not return the survey, at least partially explaining the lower response rate in that state.

Table 1. Mail Survey Completion Statistics.

State	Surveys Sent	Surveys Returned	Non-Deliverable	Response Rate
Alabama	364	161	21	50.0%
Alaska	629	391	14	64.4%
California	7,391	2,622	692	44.8%
Connecticut	139	88	6	67.6%
Delaware	1,732	780	92	50.3%
Florida	4,342	2,032	288	53.4%
Georgia	455	184	39	49.0%
Hawaii	3,715	1,057	487	41.6%
HMS	3,812	2,074	111	57.3%
Louisiana	1,723	845	62	52.6%
Maine	473	259	7	56.2%
Maryland	1,348	556	78	47.0%
Massachusetts	594	328	18	58.2%
Mississippi	175	66	13	45.1%
New Hampshire	295	151	7	53.6%
New Jersey	1,401	772	45	58.3%
New York	980	439	107	55.7%
North Carolina	1,965	992	88	55.0%
Oregon	1,191	559	48	51.0%
Rhode Island	560	274	34	55.0%
South Carolina	1,090	406	146	50.6%
Texas	7,333	1,471	1,280	37.5%
Virginia	796	361	46	51.1%
Washington	2,978	1,523	140	55.8%
<b>Total</b>	<b>45,481</b>	<b>18,391</b>	<b>3,869</b>	<b>48.9%</b>

## EXPENDITURE ESTIMATES

### Data Manipulation

The survey forms collected total expenditures made during the trip that might involve multiple days and multiple participants. The questionnaires therefore gathered information about party size and trip duration so that trip expenditures could be denominated per person and per day.

Data for all intercept survey participants and all mail survey participants contained the home zip code of the participant. Round trip travel distance between the participant's home zip code and the actual latitude and longitude of the intercept site or the county of their most recent trip, in the case of license frame states, were calculated. The American Automobile Association's 2006 average variable cost of operating a vehicle, \$0.145/mile, was used to

convert distance to private transportation expenditures (AAA 2007). While all surveys asked the respondent to supply private transportation costs, missing values in the data set were replaced with the calculated value.

Respondents to expenditure surveys often leave responses blank when the actual response to a particular expenditure category should have been zero. In the trip expenditure form, if a respondent had any non-zero response in the table, all other categories coded as missing were assumed to be zero responses. This is a minor assumption for the field survey as the interviewers were instructed not to record zero responses to save time during the interview process. To avoid making assumptions about a respondent's intentions during the durable section of these questionnaires, screening questions were added to the survey for every grouping of expenditure categories. If a respondent answered in the affirmative for expenditures in the grouping, all missing values within that grouping were coded as zeros and if the respondent answered in the negative for that grouping, all missing responses were left as missing data. All expenditure groupings included an "other" category allowing an open-ended response for expenditure type and amount. All verbatim responses were re-coded into the appropriate expenditure categories based on the author's interpretation of the response.

Because all durable goods can be used for multiple activities, each expenditure grouping, or in some cases individual categories, included a question about the percent of time the goods purchased in the grouping or category were used for saltwater fishing. The percentage given was used to reduce the expenditure amount used for estimation. The previous survey instructed the respondent to provide expenditures only for those categories in which the goods purchased were used "primarily" for saltwater fishing. In order to stay consistent with previous methodologies that used this notion of primacy, if a respondent said the item was used less than 50% of the time for saltwater fishing, the expenditure amount was re-coded as a zero.

Outliers were removed from the data set by strata (resident status and state of intercept/licensure) by expenditure category. The decision rule for outliers allowed strata with low variances to remain intact while strata with high variances had outliers removed. An initial mean estimate for all expenditures categories were made and any strata/category combination with a proportion of standard error (PSE) greater than 20% had the upper 1% of its distribution truncated.

For policy purposes, only those expenditures that generate economic activity matter. Purchases of used goods from private parties do not generate any economic activity and are considered transfer payments from one household to another. Respondents were asked if expenditures on boats, vehicles, and second homes were made new or used, from dealers or private parties, or were financed.

If a boat, vehicle, or home were purchased new the entire purchase price was used for estimation. If any of these items were purchased used from a private party and not financed, the expenditure was not included. If the purchase was financed, regardless of whether used or new, financed charges were assumed to be 2% of the loan principal. To calculate the loan principal and the 2006 interest payment to the banking sector, the Consumer Expenditure Survey (CES) microdata was used to calculate average loan term, average principal balance, and average interest rate (CES 2005). Amortization equations were used to develop the additional categories for each respondent purchasing a financed vehicle, boat, or second home.

Additionally, for second homes, the US average property tax was taken from National Association of Homebuilders estimates from the 2000 Census data (NAHB 2007). It was assumed that the real estate commissions for home purchases were 6%.

### **Weighting Strategy and Estimation**

Two weighting strategies were used for this effort: weights to address avidity bias and weight to address sampling throughout the year based on effort proportions. Intercept surveys designed to collect a random sample of trips, as in the MRIP, generally incur an avidity bias as more avid anglers have a higher likelihood being sampled. This is a type of choice based sampling. The last round of expenditure publications (Steinback and Gentner 2001; Gentner et al 2001; Gentner et al 2001a) tested for this avidity bias and found it in the data. This effort did not test for the bias, but assumed that the bias exists for the durable good expenditures originating from the MRIP intercept survey.

Because the sample of trips was random, there is no weighting necessary for the avidity bias in the trip expenditure estimates. The intercept based durable expenditures means were weighted using Thomson's (1991) weight.

All MRIP sampling was based on quotas developed using expected effort during the sampling period. Expected effort was simply the effort estimate for the same period in the previous year. The intercept trip estimates were weighted by taking the 2006 estimate of effort during the sampling period by strata divided by the annual total effort for the entire year by strata.

All license frame sampling was based on quotas developed using expected license sales during the sampling period. Expected license sales by sampling period were taken from the 2005 license files. Both trip and durable good estimates were weighted by the number of anglers sampled during the period by strata divided by the total saltwater license sales during the period.

The Proc Surveymeans procedure was used in SAS to generate weighted mean expenditures by category (SAS 2000). Total trip expenditures were calculated by applying the means to effort estimates by strata and durable totals were calculated by applying participation estimates at the strata level to the durable expenditure means. Details on the estimation of effort and participation along with detailed means, totals, and economic impacts by strata will be included in a forthcoming NMFS publication. Please contact the author for availability of that document.

Other changes to the 2006 survey that were not examined include an expansion of the durable good categories in the survey and an expansion of questions regarding the mode of acquisition of durable goods. The 2006 survey included an additional fishing equipment durable good category. Also, boating expenditures, a single category in the previous survey, was broken into four new categories; insurance, maintenance and repair, storage, and registration. Similarly for boats and second homes, vehicle expenses and home expenses were broken into insurance and maintenance categories. In the last estimation effort, the CES was used to estimate the proportion of new versus used boats, cars, and second homes, the proportion of these items purchased from private parties versus businesses, and the proportion of these items that were financed. For this survey, those questions were asked during the survey and the percentages calculated from this survey were higher for new purchases, dealer purchases, and financed purchases than either the CES values used before and the current CES values. This has the effect of increasing mean expenditures over the values that would have been used had this analysis relied on the CES data. Finally, the previous survey efforts asked respondents to only report expenditures on good "primarily" used for saltwater fishing. This survey asked the percentage of time each good was used for saltwater fishing in the last year for each expenditure category. It is impossible to compare the impact of this change to the qualitative cut off used last time.

For perspective, US total expenditures, including trip and durable good expenditures were \$31.4 billion in 2006. Trip expenditures accounted for \$5.8 billion and durable good purchases made up \$25.6 billion of that total. The single largest trip expenditure in the US was private transportation expenses at \$1.2 billion. The single largest durable equipment expenditure was new boat purchases at \$6.8 billion. The top five coastal states in terms of total expenditures were: Florida (\$16.6 billion); Texas (\$3.2 billion); California (\$3.0 billion); Louisiana (\$2.9 billion); and North Carolina (\$2.0 billion).

## **STATISTICAL TESTING**

A number of tests were conducted to explore these expenditure estimates. Below, non-response bias, survey mode differences, and the stratification of the HMS permit holders are examined. Differences in the continuous variables were tested using a Wald test in the Proc Surveyreg procedure in SAS (SAS 2000). For the categorical variables, the Rao-Scott chi-squared test was used in the Proc Surveyfreq procedure in SAS (SAS 2000). These procedures and tests were selected because they allow the test to be conducted using the various weights used here. The null hypothesis for all these tests is no difference in means across the treatment. Across all treatments, income was tested as a categorical variable as asked in the survey and it was also converted to a continuous variable using the mid-points of the interval ranges.

Following good mail survey practice, a 10% sample of non-respondents were re-contacted by phone and asked about their demographic characteristics and their expenditures on fishing gear, fishing tackle, and fishing rods and reels. Because non-respondents have already shown an unwillingness to participate in the survey, only three expenditure

categories were included in their survey to keep the survey short. The base sample contained 18,736 observations while the treatment group contained 2,399 observations. Table 2 contains the results of the test of the non-response treatment across the continuous variables collected in both surveys. Four of the six continuous variables fail to reject the null of no difference across the treatment, with only income and avidity showing a significant difference. This is good news for the expenditure estimates as no significant difference could be detected in expenditures.

Table 2. Non-Response Bias Treatment: Continuous Variables.

Expenditure Category	Sample Mean	Sample Standard Error	Treatment Mean	Treatment Standard Error	Treatment P-Value
<b>Durables</b>					
Fishing Gear	\$77.02	\$3.76	\$64.96	\$6.75	0.1184
Tackle	\$115.85	\$3.81	\$75.77	\$7.44	0.1241
Fishing Rod	\$213.08	\$8.26	\$221.81	\$36.15	0.8138
<b>Demographics</b>					
Income	\$84,592	\$974	\$76,890	\$3,331	0.0264 *
12-month Avidity	1.92	0.03	4.95	0.36	<.0001 *
Age	48.70	0.61	48.93	0.97	0.8378

\*Reject the null hypothesis. Null = no difference in means between treatments

When combined with the results from Table 3, race (almost entirely white on phone), categorical income (very different distribution of income), education (generally lower education), and employment (less full time employed and more retirees, students, homemakers, and unemployed) were found to be significantly different suggesting that while demographics are significantly different, spending patterns are not. It is hard to draw much insight into these differences; however telephone surveys can only be conducted in households with telephones perhaps driving some of these differences. Additionally, the survey was conducted in English, potentially impacting race responses. In this case, very few races besides white were represented among the non-respondents. It is also likely that more avid anglers would be more likely to participate in both surveys. Participants in the non-response survey had a 12-month avidity of 4.95 trips, while respondents had a 12-month avidity of 1.92 trips. Because the expenditure responses were not statistically different, no additional weighting was undertaken.

Table 3. All Treatments: Categorical Variables.

Demographic Category	Non-Response Treatment P-Value	Mode Treatment P-Value	HMS Treatment P-Value
Education	0.0002 *	0.0423 *	<.0001 *
Ethnicity	0.0673	0.0007 *	0.0190 *
Gender	0.5971	0.0946	<.0001 *
Race	<.0001 *	**	**
Income	0.0002 *	0.6829	**
Employment	0.0003 *	**	**

\*Reject the null hypothesis - no difference in means between treatments

\*\*Not included due to zero frequencies in treatment

For a number of reasons, the follow-up survey was conducted using a mail survey instead of a telephone survey. The primary reasons for using a mail survey were cost and the ability of the respondent to look up and provide an accounting of detailed annual expenditures. In order to compare results from the previous telephone based expenditure survey to this mail based effort, the sample in the highest sample state, Florida, was split into two groups with half receiving a mail survey and half receiving a phone survey using the same survey instrument. This test was conducted with all the mail survey completes in Florida, 2,039 surveys in total, versus the treatment group administered a phone survey, 676 surveys in total. The results of tests on all durable expenditure categories and continuous demographic variables are presented in Table 4 and the categorical tests are above in Table 3.



Of the 25 variables tested, 19 tests failed to reject the null of no significant difference. The expenditure categories found to be significantly different include: fishing gear expenditures (higher on phone), second home insurance (lower on phone), second home repair (lower on phone), vehicle purchase (higher on phone), and binocular purchase (higher on phone). For the continuous demographic variables, only 12-month avidity (lower on phone) was statistically different. Of the categorical variables education (higher on phone), ethnicity (almost no Hispanics on phone), and race (almost no non-whites on phone) were statistically different.

Table 4. Survey Mode Treatment: Continuous Variables.

Expenditure Category	Sample Mean	Sample Standard Error	Treatment Mean	Treatment Standard Error	Treatment P-Value	
<b>Durables</b>						
Fishing Gear	\$85.45	\$7.15	\$334.33	\$81.50	0.0302	*
Tackle	\$134.78	\$10.22	\$236.62	\$36.78	0.1433	
Fishing Rod	\$259.87	\$29.11	\$327.74	\$69.10	0.4701	
Second Home	\$619.82	\$352.92	\$114.57	\$109.37	0.2372	
Second Home Insurance	\$10.83	\$4.77	\$6.92	\$5.02	0.0342	*
Second Home Repair	\$20.62	\$6.82	\$3.98	\$1.78	0.0224	*
Motor Boat	\$2,747.63	\$261.16	\$3,012.92	\$1,383.57	0.5555	
Non-Motorized Boat	\$13.32	\$3.79	\$22.27	\$12.38	0.7316	
Boat Insurance	\$111.54	\$9.52	\$163.16	\$59.47	0.2274	
Boat Registration	\$24.27	\$1.86	\$30.81	\$5.90	0.1124	
Boat Maintenance	\$102.69	\$11.88	\$131.10	\$24.92	0.1258	
Boat Accessory	\$199.65	\$18.24	\$152.70	\$36.02	0.6231	
Boat Storage	\$81.91	\$15.84	\$88.94	\$44.34	0.6723	
Vehicle	\$930.64	\$164.99	\$2,313.04	\$1,220.18	0.0176	*
Vehicle Repair	\$56.49	\$11.16	\$130.35	\$48.91	0.2969	
Vehicle Insurance	\$93.81	\$13.42	\$147.29	\$42.53	0.3092	
Camping Equipment	\$25.82	\$5.92	\$15.96	\$6.62	0.0525	
Clothing	\$40.02	\$3.33	\$71.02	\$16.63	0.1662	
Fishing Club Dues	\$11.50	\$1.37	\$9.20	\$2.36	0.3718	
Taxidermy	\$11.23	\$3.64	\$17.28	\$13.49	0.5202	
Binoculars	\$10.99	\$1.80	\$18.03	\$11.25	0.0026	*
Fishing License	\$23.51	\$1.63	\$20.41	\$3.60	0.4322	
<b>Demographics</b>						
Income	\$87,209	\$2,867	\$98,832	\$8,453	0.6829	
12-month Avidity	6.97	0.29	5.42	0.34	0.0005	*
Age	50.02	0.62	46.88	54.69	0.1835	

\*Reject the null hypothesis. Null = no difference in means between treatments

One interesting note, while the mail survey in Florida met with a 53.4% response rate, the telephone survey met with a 5.1% response rate primarily due to bad telephone numbers collected during the intercept phase or initial refusal of the telephone number question during the field portion of the survey. A phone number look-up survey was used but little success was met. Interestingly, respondents were far more likely to supply a valid mailing address. This poses a problem for statistical tests as it is easier to show a statistical difference when sample sizes and therefore variances are disparate. Also, second home expenditures, including purchases, maintenance and insurance, were subject to small sample sizes even in the mail survey. That is, these types of expenditures are very rare as evidenced by the high standard errors. For example the PSE on the mail survey for second home insurance was 44% while on the phone survey it was 73%. The low response rate on the phone coupled with the rare event nature of the four expenditure categories that were statistically different, second home insurance, second home repair, vehicle

purchases, and binocular purchases, may be driving the result of this test. As expected, the phone survey was biased toward non-hispanic whites with higher education.

Typically, HMS species are found farther offshore and require more fuel to reach and require more expensive, heavier duty gear than inshore anglers. It was hypothesized that HMS angler should belong to their own stratum because their expenditures were higher than non-HMS anglers. To validate this hypothesis, means were compared between all other anglers in the US and HMS anglers that only fish recreationally. The treatment group in this case contained 1,948 completed surveys and the non treatment group contained 117,043 completed surveys. The results of the continuous variable tests are shown in Table 5, while the results of the categorical variable tests are in Table 3 above.

Because HMS anglers were mailed as part of the larger license based sample design, the test includes trip and durable expenditures. Only eight out of 48 variables tested failed to reject the null of no difference between groups. All demographic variables are different with income and education significantly higher for HMS anglers. Of the durable expenditure variables only second home insurance, repair and purchase, boat purchases, vehicle purchase and repair were not different. For the trip expenditures, rental car expenditures and fish processing expenditures were not different. This gives strong support to separating HMS anglers and supports the hypothesis of higher expenditures within this stratum as all means were higher than the general population of anglers.

## **DISCUSSION**

The comparison of the non-response survey to the base survey showed that while demographic characteristics were both statistically different and statistically similar, tackle, gear, and rod and reel expenditures could not be shown to be different. As a result, no additional weighting for non-response was conducted as, at least across the categories in the non-response survey, no significant differences were found. No attempt was made to examine non-response on the field intercept survey as no contact information is available from those anglers refusing to participate in the field.

While the primary purpose of using a mail survey this time was to allow anglers to more accurately respond to questions about detailed durable expenditures, a secondary consideration were falling phone survey response rates due to negative respondent perceptions about phone surveys and the increase in cell phone only households. Regarding the first point, it was hypothesized that there would be an upward digit bias in the phone survey responses as anglers, when given a short amount of time to respond, would round purchases upwards. In this case, more expenditure items were similar than different showing that there isn't a great deal of difference between mail survey and phone survey modes. However, 16 of the 22 durable expenditure categories had higher means on the phone survey even though those responses were not statistically different. Exceptions include fishing gear purchases, second home insurance and repair expenses, vehicle purchase expenses, and binocular purchases. The largest difference was across fishing gear purchases, with phone gear mean expenditures almost four times higher than mail survey gear expenditures. The second largest difference was across vehicle purchase expenditures which were 31% higher on the phone survey. Income differences may explain some of this difference as income from the phone survey, while not statistically different, was 13% higher on the phone. As a result, it was decided that there was no significant impact of survey mode on the expenditure estimates and no additional weighting was undertaken.

Regarding falling phone survey response rates, it was expected that response rates would be higher using a mail survey and that was indeed the case. Anglers were far more likely to supply a working address than a working telephone number resulting in a 53% response rate to the mail survey and a 17% response rate for the phone survey. The non-response on the phone survey came from the following sources: 33% of all numbers dialed could not be resolved, likely due to call screening; 18% refused the survey outright; 26% claimed not to have any fishing activity in the last two months even though the calls were made within two months of the intercept. The remainder of the non-response was due to non-working phone numbers, cell phones (less than 1%), or language barriers (less than 1%). From this result, it is recommended that future survey utilize a mail survey. While mail surveys are more costly per contact, this study shows that mail surveys were more cost effective in obtaining completed surveys.

Table 5. HMS Treatment: Continuous Variables.

Expenditure Category	Sample Mean	Sample Standard Error	Treatment Mean	Treatment Standard Error	Treatment P-Value	
<b>Durables</b>						
Fishing Gear	\$79.42	\$2.89	\$275.54	\$10.57	<.0001	*
Tackle	\$115.85	\$3.81	\$452.28	\$14.28	<.0001	*
Fishing Rod	\$144.10	\$5.90	\$1,097.72	\$40.06	<.0001	*
Second Home	\$8.83	\$2.11	\$167.86	\$144.11	0.2697	
Second Home Insurance	\$0.22	\$0.05	\$4.67	\$3.31	0.1787	
Second Home Repair	\$1.24	\$0.47	\$13.19	\$12.49	0.3389	
Motor Boat	\$849.01	\$68.88	\$724.45	\$162.70	0.4807	
Non-Motorized Boat	\$5.07	\$1.08	\$1.43	\$0.74	0.0055	*
Boat Insurance	\$34.83	\$2.00	\$228.92	\$18.58	<.0001	*
Boat Registration	\$8.21	\$0.38	\$13.16	\$1.07	<.0001	*
Boat Maintenance	\$43.74	\$8.37	\$201.44	\$26.09	<.0001	*
Boat Accessory	\$82.05	\$6.68	\$275.33	\$32.07	<.0001	*
Boat Storage	\$32.50	\$3.58	\$332.01	\$29.43	<.0001	*
Vehicle	\$11.29	\$1.64	\$61.76	\$35.21	0.1521	
Vehicle Repair	\$0.75	\$0.27	\$2.15	\$0.89	0.1327	
Vehicle Insurance	\$0.97	\$0.10	\$3.84	\$1.04	0.0060	*
Camping Equipment	\$0.88	\$0.23	\$4.84	\$0.65	<.0001	*
Clothing	\$30.24	\$1.27	\$146.54	\$4.97	<.0001	*
Fishing Club Dues	\$3.53	\$0.23	\$75.04	\$4.62	<.0001	*
Taxidermy	\$0.22	\$0.05	\$10.21	\$1.96	<.0001	*
Binoculars	\$0.57	\$0.06	\$45.39	\$3.42	<.0001	*
Fishing License	\$15.54	\$0.56	\$54.45	\$2.63	<.0001	*
<b>Trip</b>						
Private Transportation	\$13.37	\$0.13	\$13.91	\$0.56	<.0001	*
Rental Car	\$1.85	\$0.16	\$0.52	\$0.12	0.9977	
Bait	\$1.42	\$0.03	\$15.21	\$0.68	<.0001	*
Boat Fuel	\$2.33	\$0.06	\$120.98	\$6.28	<.0001	*
Boat Rental	\$0.11	\$0.03	\$27.78	\$4.01	<.0001	*
Charter Tips	\$1.32	\$0.05	\$0.00	\$0.00	<.0001	*
Tournament Fee	\$0.27	\$0.02	\$21.06	\$2.90	<.0001	*
Grocery	\$8.07	\$0.30	\$21.74	\$1.93	<.0001	*
Charter Fee	\$34.35	\$0.58	\$0.00	\$0.00	<.0001	*
Ice	\$0.59	\$0.02	\$6.10	\$0.30	<.0001	*
Lodging	\$14.55	\$0.58	\$10.97	\$1.35	0.0066	*
Parking	\$0.61	\$0.03	\$0.24	\$0.03	<.0001	*
Processing	\$0.01	\$0.00	\$0.04	\$0.02	0.1212	
Public Transportation	\$1.38	\$0.10	\$6.45	\$0.96	<.0001	*
Restaurant	\$8.66	\$0.26	\$13.92	\$0.78	<.0001	*
Trip Tackle	\$2.68	\$0.20	\$1.53	\$0.22	<.0001	*
Gift	\$1.99	\$0.06	\$33.35	\$3.64	0.0158	*
<b>Demographics</b>						
Income	\$83,782.31	\$987.27	\$135,274	\$1,575	<.0001	*
12-month Avidity	1.03	0.00	37.44	0.81	<.0001	*
Age	48.66	0.62	51.27	0.25	0.0001	*

\*Reject the null hypothesis. Null = no difference in means between treatments

With regards to the HMS permit holders, they clearly belong in a separate stratum. Very few HMS expenditure categories were not statistically different and even fewer expenditure categories showed lower expenditures for HMS anglers than the control group of all anglers. Across all expenditure categories that were higher for HMS anglers, HMS anglers spend 1.5 to 248 times more than non-HMS anglers. As a result, it is recommended that HMS anglers be included as a separate stratum as this survey moves into the future.

Finally, it is recommended that NMFS move forward using this same methodology and questionnaire for future expenditure surveys. Non-response surveys should be conducted as standard survey practice and trip expenditure questions should be added to the non-response form. It is also recommended that NMFS continue with the mail survey and separate HMS permit holders into their own stratum. Other recommendations for further methodological research involve comparing the consumer price index inflator to the implied inflator from previous survey efforts now that the survey mode does not appear to have a significant impact on the magnitude of expenditure estimates. Additionally, the CES estimates used in previous survey efforts (percentage purchased new, percentage financed, etc.) should be compared to the same data collected directly from anglers during this effort.

## REFERENCES

- AAA. (2007). American Automobile Association, *Your Driving Costs* (Heathrow, FL: 2007)
- CES. 2005. U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, Diary Survey.
- Cochran, W.G. (1977). *Sampling Techniques*, 3<sup>rd</sup> edn. Wiley, New York.
- Dillman, D.A. (2000). *Mail and Internet Surveys: The Tailor Design Method*. 2<sup>nd</sup> edn. Wiley, New York.
- Gentner, B, S. Steinback, and M. Price (2001). Marine Angler Expenditures in the Southeast Region, 1999. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/SPO-48.
- Gentner, B., S. Steinback, and M. Price (2001a). Marine Angler Expenditures in the Pacific Coast Region, 2000. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/SPO-49.
- Groves, R.M., Biemer, P.P., Lyberg L.E., Massey J.T., Nichols, W.L. II, and Waksberg J. (1988). *Telephone Survey Methodology*. Wiley, New York.
- Hamilton, M.S. and S.W. Huffman (1997). Cost-Earnings Study of Hawaii's Small Boat Fishery 1995-1996. University of Hawaii, Joint Institute for Marine and Atmospheric Research. JIMAR Contribution 97-314. 104pp.
- Leitz, J. (2007). Personal Communication. Human Dimensions Research Specialist. Texas Parks and Wildlife Department, Coastal Fisheries Division.
- NAHB. (2007). National Association of Home Builders. Effective Property Tax Rates. Online Data. Available at <http://www.nahb.org/generic.aspx?genericContentID=35450>. Last accessed April 7<sup>th</sup>, 2008.
- PSFMC, 2008. California Recreational Fisheries Survey Methods. Online Document - [http://www.recfin.org/lib/2006/CRFS\\_Description\\_Update\\_June\\_2006.pdf](http://www.recfin.org/lib/2006/CRFS_Description_Update_June_2006.pdf). Last accessed April 7<sup>th</sup>, 2008.
- SAS. (2000). SAS OnlineDoc<sup>®</sup>, Version 8. SAS Institute Inc.
- Steinback, S., B. Gentner, and J. Castle. (2004) Economic Impacts of Marine Recreational Angling in the United States. NOAA Professional Paper NMFS 2, 169 p.
- Steinback, S., and B. Gentner (2001). Marine Angler Expenditures in the Northeast Region, 1998. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/SPO-47.
- Thomson, C.J. (1991). Effects of Avidity Bias on Survey Estimates of Fishing Effort and Economic Values. American Fisheries Society Symposium. 12:356-366.